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## Indiana State Climate Office

### Monthly Weather Report



<http://www.iclimate.org>

**Jan 6, 2011**



## December 2010 Climate Summary

### Summary

Winter began in Indiana right on cue on December 1<sup>st</sup>, the start of meteorological winter. Weather the next few weeks would be harsh with subnormal cold, frequent snow storms, and lake effect blizzards. The final week of the month was much quieter as the year ended with an amazing thaw.

A very warm 2010 began to cool in November and this cooling trend continued into December. The state average temperature of 24.7° this month is 6.4° below normal, which ranks as the 11<sup>th</sup> coldest December in Indiana since 1895. The most recent December that was colder was in 2000 which came in at 2<sup>nd</sup> coldest on record at 19.3°. The 1989 state average temperature of 18.4° marks the coldest December in Indiana record books. Daily average temperatures for December 2010 were below normal on 24 days. Daily means this month were more than 20° below normal on 2 days, more than 10° below normal on 8 days, and more than 10° above normal on just one day. The highest recorded temperature of the month was 60° at Greensburg on December 1<sup>st</sup> and the coldest was -12° at Portland on December 14<sup>th</sup>.

Precipitation returned to its old ways as December 2010 was a drier than normal month. Certainly the dominance of snow events rather than rain events during the month contributed to the low liquid totals. The state average total precipitation was 1.46 inch this December, which is 1.60 inch below normal or about 48% of normal. This total places December 2010 as the 16<sup>th</sup> driest December on record in Indiana and the driest in the past 34 years as the 0.61 inch total in 1976 ranks in third place. Locally the heaviest precipitation for December 2010 was measured as 4.77 inches by the CoCoRaHS observer in Connersville. The lightest reliable total was 0.64 inch recorded at Remington. Connersville also recorded the highest one day amount of 3.00 inches on December 5<sup>th</sup> while the Highland observer noted 2.12 inches on December 13<sup>th</sup>. Overall this month precipitation averaged about 1.4 inches in northern and central Indiana and 1.7 inches across the south, only about half the normal December precipitation statewide.

Snow fell on approximately 23 days this month. About 2 to 5 inch totals were common across southern Indiana and 5 to 15 inches in central areas. Snowfall was least in the northeast where 5 to 10 inches was noted. About 15 to 20 inches fell across most of northwest Indiana while 20 to 47 inches piled up in the core lake effect region southeast of Lake Michigan. Some local snow totals in this region include 47.1 inches at Wanatah, 40.2 inches in Laporte, 31.2 inches at North Judson, and 30.8 inches at Valparaiso according to CoCoRaHS reporters in these cities.

The frequent snowfall caused many travel problems during the month. A series of fronts passing through the state certainly triggered some snow events. But the heaviest snowfalls were setup by

the northerly fetch winds which had absorbed moisture the length of Lake Michigan and released this moisture over the colder land, long after the fronts had moved east of Indiana. Travel was most impacted by inclement weather on four dates: December 1<sup>st</sup>, 13<sup>th</sup>, 16<sup>th</sup>, and 24<sup>th</sup>. Details can be found in the weekly narratives which follow. The most significant travel impact occurred on December 13<sup>th</sup> when more than 100 drivers became snowbound in a lake effect blizzard. They were forced to spend overnight on a stretch of US30 near Wanatah until they were rescued the next day. The strong winds also created 25 foot high waves on Lake Michigan which caused severe erosion to the sand dunes along Indiana beaches.

Christmas came and went and so did three weeks of inclement weather. A dramatic warm up the final days of 2010 ate the snowpack in barely two days. Grass was visible again and the nasty storms of December were just a memory.

Drought conditions changed little throughout December. When the month began the National Drought Monitor classified 1% of Indiana in severe drought (D2 class), 29% in moderate drought (D1 class), 65% as extremely dry (D0 class), and 5% as drought free. At the close of the month no areas remained in severe drought (D2 class) status. About 14% of the area was classified in moderate drought (D1 class), 79% as abnormally dry (D0 class), and 7% was rated as not in drought status. Over the month this small shift into D0 class indicates a slow gradual improvement in the Indiana drought picture. (Weekly county drought maps are shown near the end of this report.).

As expected open burn bans ended in all Indiana counties in early December as much colder temperatures and frequent snowfall have diminished outdoor fire risks.

### **December 1<sup>st</sup> – 10<sup>th</sup>**

Winter officially begins on December 21<sup>st</sup> by the calendar but climatologists define December 1<sup>st</sup> as the start of meteorological winter. The earlier date seems more on target this year as a cold arctic air mass with snowfall slammed Indiana and the Midwest only a few days into the new month. Daily state average temperatures held below normal all ten days this first interval of December. Two cold fronts at the top of the month kept temperatures 7° to 9° below normal. The first significant snowfall of the season on December 4<sup>th</sup> announced the arrival of the arctic air which sacked temperatures another 10°. By December 6<sup>th</sup> daily average temperatures had sunk to an unseasonably cold 19° below normal. The intense early season cold stayed for a few more days. A welcome warm up arrived to close the interval at 5° below normal. Overall the mean temperature over the ten days averaged 11° below normal. Typically this first week of December daily maximum temperatures should range between 41° and 50° north to south across Indiana. Daily minimums normally vary from 28° to 33° around the state.

The arctic fronts raced eastward and only had time to transport heavier moisture into southeastern Indiana. But strong northerly winds later behind the fronts picked up additional moisture as they swept the length of Lake Michigan. Bands of lake effect snow persisted on the southeast shore of the lake and added more snow in this area especially early on December 7<sup>th</sup>. The heaviest reported daily snowfall that morning was 8.0 inches by the CoCoRaHS observer in Wanatah. Other heavier snowfall amounts included 6.6 inches at Granger and 6.3 inches in Goshen. For the entire ten day interval new snowfall totals topped out at 15.1 inches in Goshen and 14.6 inches at Wanatah.

Precipitation fell nearly every day across northern Indiana while amounts were mostly limited to mid week in central and southern Indiana. For the ten days about a third of an inch in liquid equivalent was measured statewide. These totals are about one third normal in northern and central Indiana and just one fourth normal in the south. Typically during this interval around 0.9 inch is expected in northern and central Indiana and nearly 1.2 inch in the south. The heaviest single day precipitation amount was 3.00 inches noted by the CoCoRaHS observer in Connersville on December 5<sup>th</sup>. For the full ten days Connersville recorded 3.36 inches.

Snowfall was light on December 1<sup>st</sup> but drivers were caught off guard by the first winter event of the season. Freezing rain had fallen overnight before the snow and the mix resulted in several vehicle accidents on I-65 and I-74. On Indiana 25 a semi loaded with fuel was forced down an embankment after a collision with a car in Tippecanoe county, halting traffic for several hours. The snowstorm late on December 6<sup>th</sup> came with strong winds and blowing snow, causing near zero visibility and very slick roads. Travel was very difficult overnight all across the northern part of the state.

The precipitation in southern Indiana so far in December has helped improve drought conditions in that area. The December 7<sup>th</sup> release of the National Drought Monitor has moved southern counties which were in the moderate drought category (D1 class) to the abnormally dry classification (D0 class). Only parts of counties along the Ohio River in extreme south central Indiana remain in moderate drought. The drought status in all other areas of Indiana was unchanged from the previous week. A county drought map of the December 7<sup>th</sup> revision is included near the end of this monthly report.

### **December 11<sup>th</sup> – 17<sup>th</sup>**

Winter continued in earnest this week. Another arctic air mass poured into Indiana on December 12<sup>th</sup> with intense cold. But the greater misery was a major lake effect snowfall the next day behind the cold front which made travel impossible in our northwestern counties. Skies cleared briefly on December 15<sup>th</sup> under a narrow ridge of high pressure. Then a weather system south of Indiana spread a mess of precipitation northward, this time causing traffic problems in central and southern Indiana. A Pacific air mass spread eastward into Indiana as the week closed with the promise of moderating temperatures.

The arctic blast to start this week caused state average temperatures to plunge from 4° above normal to 17° below normal in just two days. By December 14<sup>th</sup> temperatures bottomed out at 21° below normal as polar air was pipelined to Indiana directly from the arctic. The unseasonable cold moderated quickly at the end of the week as temperatures rebounded to 7° below normal. For the week overall temperatures around the state averaged 12° below normal. Typical mid December daily maximum temperatures should range between 38° and 46° north to south across the state while normal daily minimums would vary from 25° to 30°.

Precipitation was heaviest during the two storm events, early and late in the week. Liquid equivalent totals were generally about 0.8 inch in northern Indiana, 0.7 inch in central, and 0.9 inch across the south. These totals are near or a little above the normals of 0.6 inch in northern, 0.7 inch in central, and 0.8 inch in southern Indiana. The CoCoRaHS observer in Greensburg measured 4.00 inches in the rain gauge on December 15<sup>th</sup>, the highest one day reading in the state this week. On

December 13<sup>th</sup> the Highland observer noted 2.12 inches while Dubois recorded 1.70 inch that day. The observer at Dubois also reported the highest complete weekly total at 2.16 inches.

Snowfall amounts were impressive in the northwest lake effect region of the state. On December 14<sup>th</sup> the CoCoRaHS reporter in Wanatah measured 18.0 inches of new daily snowfall. On the previous day Westville noted 16.0 inches, Kingsbury 14.0 inches, and the Laporte observer had 13.5 inches. For the week the Wanatah location accumulated 32.5 inches of snow, while Westville had 29.0 inches, Laporte had 25.3 inches, and North Judson recorded 20.9 inches!

All that snowfall with high winds virtually shut down Porter and Laporte counties on December 13<sup>th</sup> and stranded numerous motorists. Blizzard conditions and whiteouts hampered travelers on I-94 in Porter and Laporte counties. It was reported that more than 100 vehicles were stranded in drifts up to 6 feet high in a 10 mile stretch of US 30 near Wanatah and on state road Indiana 2 for more than 15 hours overnight. All were rescued the next morning as the Indiana department of transportation sent an additional 18 trucks and 31 drivers from central and southern Indiana to the region to assist in the rescue efforts. Officials in the impacted counties declared emergency orders for all vehicles to stay off the roads. Surprisingly only 379 customers were without power Monday, most of these in LaPorte.

In Lake County there were 14 east-west roads closed to traffic early on December 13<sup>th</sup> because of drifting snow. Porter county lifted its emergency order that evening. By this time all highways in northwestern Indiana had reopened and were improving, although blowing and drifting snow continued to be a problem at times.

To the south in Jasper county, roads were treacherous due to blowing snow icing the highways. Road conditions were not nearly as severe in central and southern Indiana where only a few slide offs and slippery roads were noted. Many minor personal injury crashes had taken place since the afternoon of December 12<sup>th</sup>, but no fatalities had occurred.

High winds during these stormy days created 25 foot waves on Lake Michigan. These waves caused severe erosion of sand dunes on the Indiana shoreline. The waves scoured sand all along the coast and left sand cliffs on the beaches. Building inspectors said that while before the storm beach property owners could walk all the way down to the beach, now they have 12 to 15 foot tall sand cliffs to climb over.

The second storm of the week hit central and southern Indiana on December 16<sup>th</sup>, but the impacts were not as extreme as northern Indiana experienced a few days earlier. Numerous slide offs on I-65 were reported in White County, including about 15 incidents at once. In Tippecanoe county police had responded to about a dozen crashes throughout the morning but without serious injuries. Meanwhile in southern Indiana, about a quarter inch of ice covered most of Clark and Floyd counties with light snow to the north. Only three homes experienced power outages and a few minor accidents were reported, including slip and fall cases on icy sidewalks.

The heavy lake effect snowfall helped improve drought conditions in northwest Indiana. Most of Laporte and Newton counties and parts of Porter and Benton counties were removed from drought status according to the December 14<sup>th</sup> edition of the National Drought Monitor. There were minor reductions in areal coverage of all previous moderate drought (D1 class) regions classified in the

December 7<sup>th</sup> edition. All other areas were unchanged. The December 14<sup>th</sup> Indiana drought map is attached near the end of this monthly summary.

### **December 18<sup>th</sup> – 24<sup>th</sup>**

Two new storm systems visited Indiana this week but without the brutal cold temperatures of a week ago. After a frigid start with three days of temperatures 8° below normal, a Pacific air mass arrived in the Midwest and quickly lifted temperatures to normal by December 21<sup>st</sup>. The next day was even a bit warmer with temperatures 2° above normal ending a 10 day cold spell. Colder air returned to end the week a few degrees below normal but without the extremes of last week. Overall for the week state average temperatures were 4° below normal. Usually for this week of December daily maximum temperatures should range between 35° and 42° north to south across Indiana. Normal daily minimums typically vary between 21° and 25°.

A storm system to the south of Indiana forced warmer air over the top of colder air refrigerated by snow cover at ground level. Precipitation began as snow on December 21<sup>st</sup> before changing to freezing rain, then rain, and back to snow in central Indiana while mostly snow fell across the north. Melted precipitation totals across Indiana were generally between 0.10 inch and 0.15 inch during this storm but there were locally heavier amounts. The CoCoRaHS observer at Valparaiso noted 1.64 inch of precipitation while the Plainfield volunteer measured 0.44 inch and 0.40 inch fell at Edinburg during the December 21<sup>st</sup> event.

Snowfall amounts during this December 21<sup>st</sup> storm totaled 3 to 5 inches across central Indiana and up to 2 inches in northern counties which were further from the storm center. Some of the heavier local snow totals included 5.0 inches at Plainfield, 4.5 inches at Rensselaer, and 4.3 inches in Lebanon. The second storm of the week arrived in Indiana in late afternoon on Christmas Eve. A low pressure wave in the upper atmosphere triggered an overnight snow that insured a white Christmas morning for most Hoosiers. Up to 5 inches of snow fell in the Lafayette area with 2 to 3 inches common elsewhere in western Indiana. About an inch fell along Lake Michigan with light amounts in much of eastern Indiana. As expected many vehicle slide offs occurred on interstates and other roadways in the midst of heavy Christmas Eve travel. Police reported most problems were in the Lafayette area where snowfall was heaviest.

The two storms this week added little new moisture to Indiana soils. This is reflected in this week's National Drought Monitor map for Indiana which is unchanged from the soil moisture status reported a week ago.

### **December 25<sup>th</sup> – 31<sup>st</sup>**

Winter weary Hoosiers welcomed a break from weeks of unseasonable cold and snow late this week. A major shift in the upper atmospheric pressure pattern during the week chased winter from Indiana in the closing days of 2010, at least for a little while. A cold upper air trough transported Canadian air into our state just after Christmas, lowering state average temperatures from normal to 8° below normal by December 27<sup>th</sup>. As a ridge of warm air approached Indiana from the west, temperatures at first rose a bit more each day, reaching 6° above normal late in the week. Next came a sudden surge of warmer air, lifting state average temperatures to 21° above normal to end the year, melting all snow cover remaining from winter storms past. Overall for the week daily

temperatures averaged 2° above normal. Typically in this last week of the year daily maximum temperatures would range from 34° to 43° north to south across the state. Daily minimums normally vary between 21° and 27°.

As Christmas Day dawned a winter storm was winding down across Indiana. That morning up to 5 inches of snow was measured in the Lafayette area with 2 to 3 inches common elsewhere in western Indiana. About an inch had fallen along Lake Michigan with light amounts in much of eastern Indiana. On Christmas Day an additional half inch accumulated especially in eastern Indiana as the storm departed our state and later evolved into a major blizzard along the Atlantic coast. It was dry in Indiana the next several days until rain fell with the arrival of much warmer air on December 30<sup>th</sup>. The heaviest amounts were noted by CoCoRaHS observers in Lake county, including 1.24 inch in Hammond and 1.20 inch in Merrillville. The Dyer volunteer measured 1.08 inch while 0.97 inch was recorded in Munster. For the entire week 1.49 inch of precipitation was observed in Hammond and 1.31 inch in Dyer.

On a regional basis weekly liquid equivalent precipitation totaled about a quarter inch in northern and central Indiana and just shy of a half inch in southern Indiana. These amounts represent about two thirds the normal weekly total in southern Indiana and one third the usual amounts in northern and central sections. Yet even with the drier than normal week the National Drought Monitor indicates no change in the state drought status since the middle of December. The very low evaporation rates during the recent cold spell obviously are a primary factor in this soil moisture status evaluation.

<b>December Temperature</b>			
<b>Region</b>	<b>Temperature</b>	<b>Normal</b>	<b>Deviation</b>
Northwest	21.5	28.5	-7.0
North Central	22.9	28.7	-5.8
Northeast	23.3	28.6	-5.3
West Central	22.9	30.4	-7.5
Central	23.2	30.7	-7.5
East Central	23.1	30.2	-7.1
Southwest	28.2	34.5	-6.4
South Central	27.3	34.5	-7.2
Southeast	26.5	34.0	-7.5
<b>State</b>	24.3	31.1	-6.8

<b>Precipitation</b>				
<b>Region</b>	<b>Precipitation</b>	<b>Normal</b>	<b>Deviation</b>	<b>Percent of Normal</b>
Northwest	1.81	2.66	-0.85	68
North Central	1.37	2.79	-1.42	49
Northeast	1.11	2.68	-1.57	41
West Central	1.62	2.96	-1.35	55
Central	1.46	2.99	-1.52	49
East Central	1.22	2.87	-1.65	43
Southwest	1.46	3.53	-2.07	41
South Central	1.65	3.56	-1.91	46
Southeast	1.97	3.41	-1.44	58
<b>State</b>	1.52	3.06	-1.54	50

## Winter 2010-2011 so far (same as December)

Region	Temperature	Temperature	
		Normal	Deviation
Northwest	21.5	28.5	-7.0
North Central	22.9	28.7	-5.8
Northeast	23.3	28.6	-5.3
West Central	22.9	30.4	-7.5
Central	23.2	30.7	-7.5
East Central	23.1	30.2	-7.1
Southwest	28.2	34.5	-6.4
South Central	27.3	34.5	-7.2
Southeast	26.5	34.0	-7.5
<b>State</b>	<b>24.3</b>	<b>31.1</b>	<b>-6.8</b>

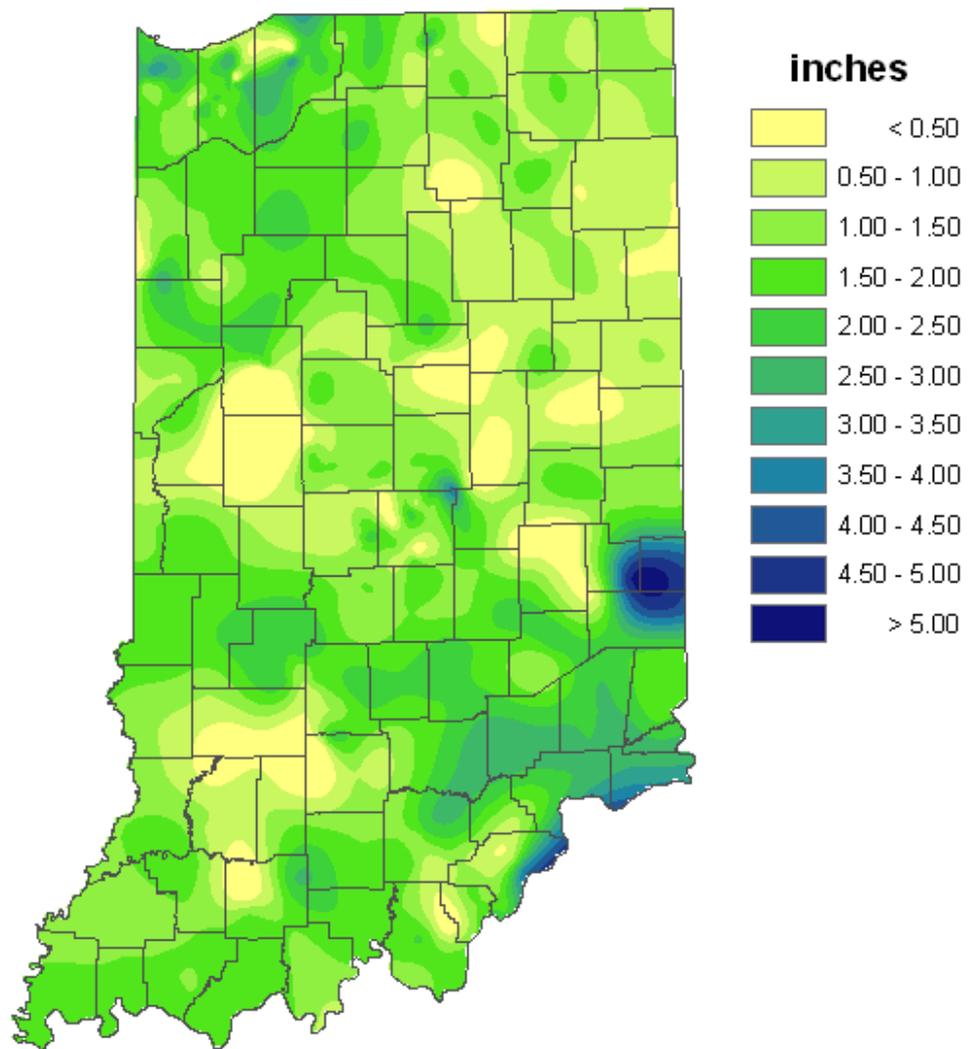
Region	Precipitation	Precipitation		
		Normal	Deviation	Percent of Normal
Northwest	1.81	2.66	-0.85	68
North Central	1.37	2.79	-1.42	49
Northeast	1.11	2.68	-1.57	41
West Central	1.62	2.96	-1.35	55
Central	1.46	2.99	-1.52	49
East Central	1.22	2.87	-1.65	43
Southwest	1.46	3.53	-2.07	41
South Central	1.65	3.56	-1.91	46
Southeast	1.97	3.41	-1.44	58
<b>State</b>	<b>1.52</b>	<b>3.06</b>	<b>-1.54</b>	<b>50</b>

## 2010 Annual

Region	Temperature	Temperature	
		Normal	Deviation
Northwest	51.0	50.2	0.8
North Central	50.9	49.8	1.1
Northeast	50.8	49.5	1.4
West Central	52.4	51.9	0.5
Central	52.3	51.5	0.9
East Central	51.7	50.7	1.0
Southwest	55.9	55.1	0.9
South Central	55.1	54.5	0.6
Southeast	54.3	53.7	0.6
<b>State</b>	<b>52.8</b>	<b>51.9</b>	<b>0.9</b>

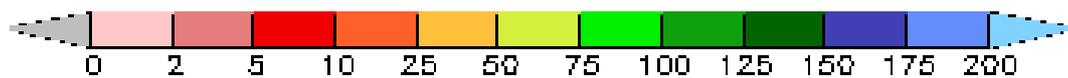
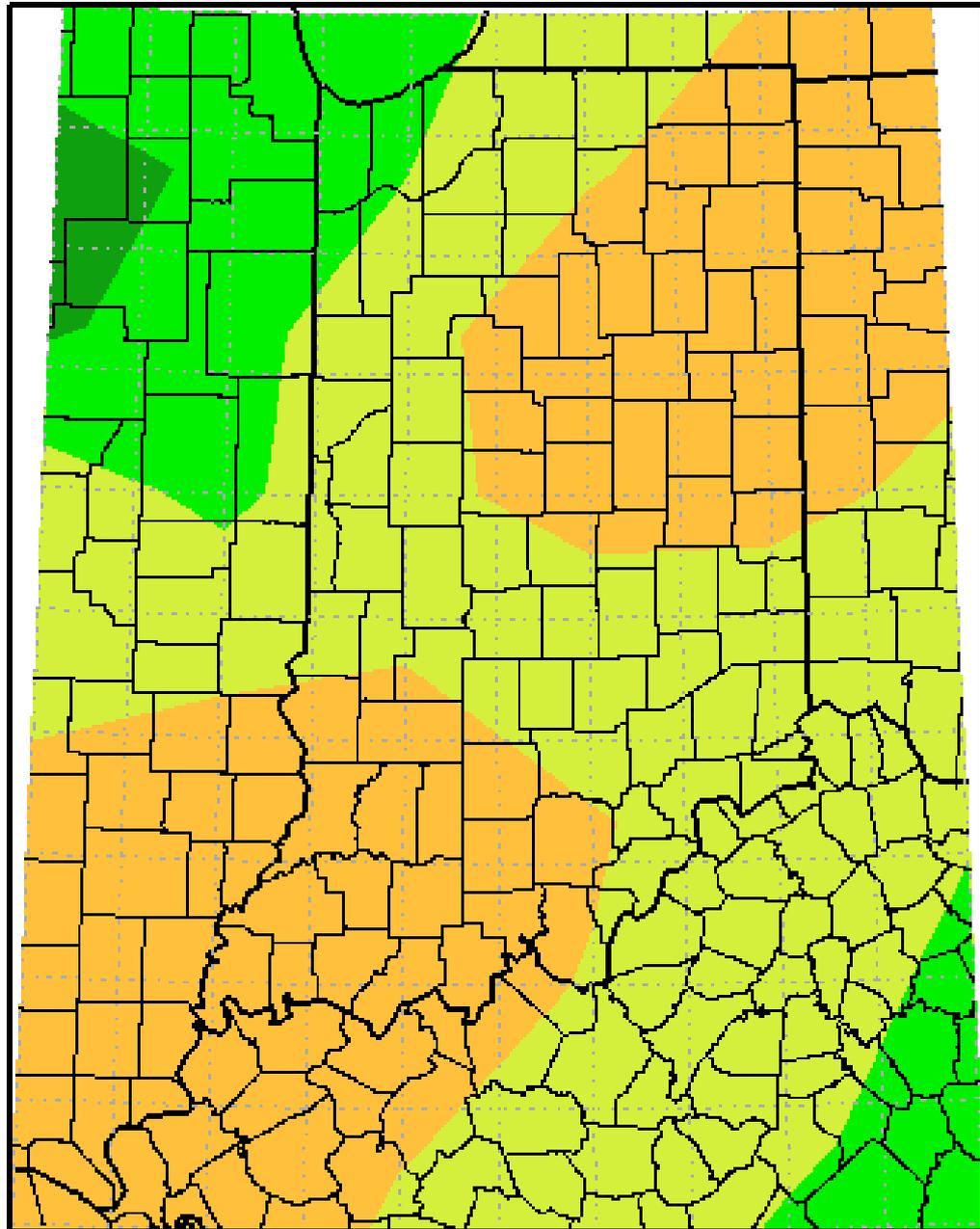
Region	Precipitation	Precipitation		Percent of Normal
		Normal	Deviation	
Northwest	36.95	38.01	-1.06	97
North Central	35.80	38.19	-2.39	94
Northeast	34.62	36.75	-2.13	94
West Central	37.05	41.23	-4.18	90
Central	39.96	40.74	-0.78	98
East Central	38.32	39.23	-0.92	98
Southwest	38.53	45.56	-7.03	85
South Central	38.83	45.70	-6.87	85
Southeast	38.36	44.12	-5.76	87
<b>State</b>	37.75	41.18	-3.43	92

**Total Precipitation  
December 2010  
CoCoRaHS network  
(320 stations)**



Analysis by Indiana State Climate Office  
Web: <http://www.iclimate.org>

**Total Precipitation Percent of Mean  
December 1, 2010 to December 31, 2010**

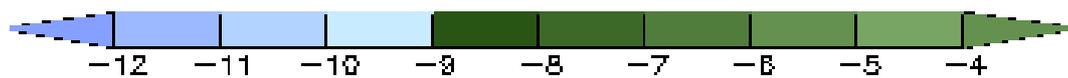
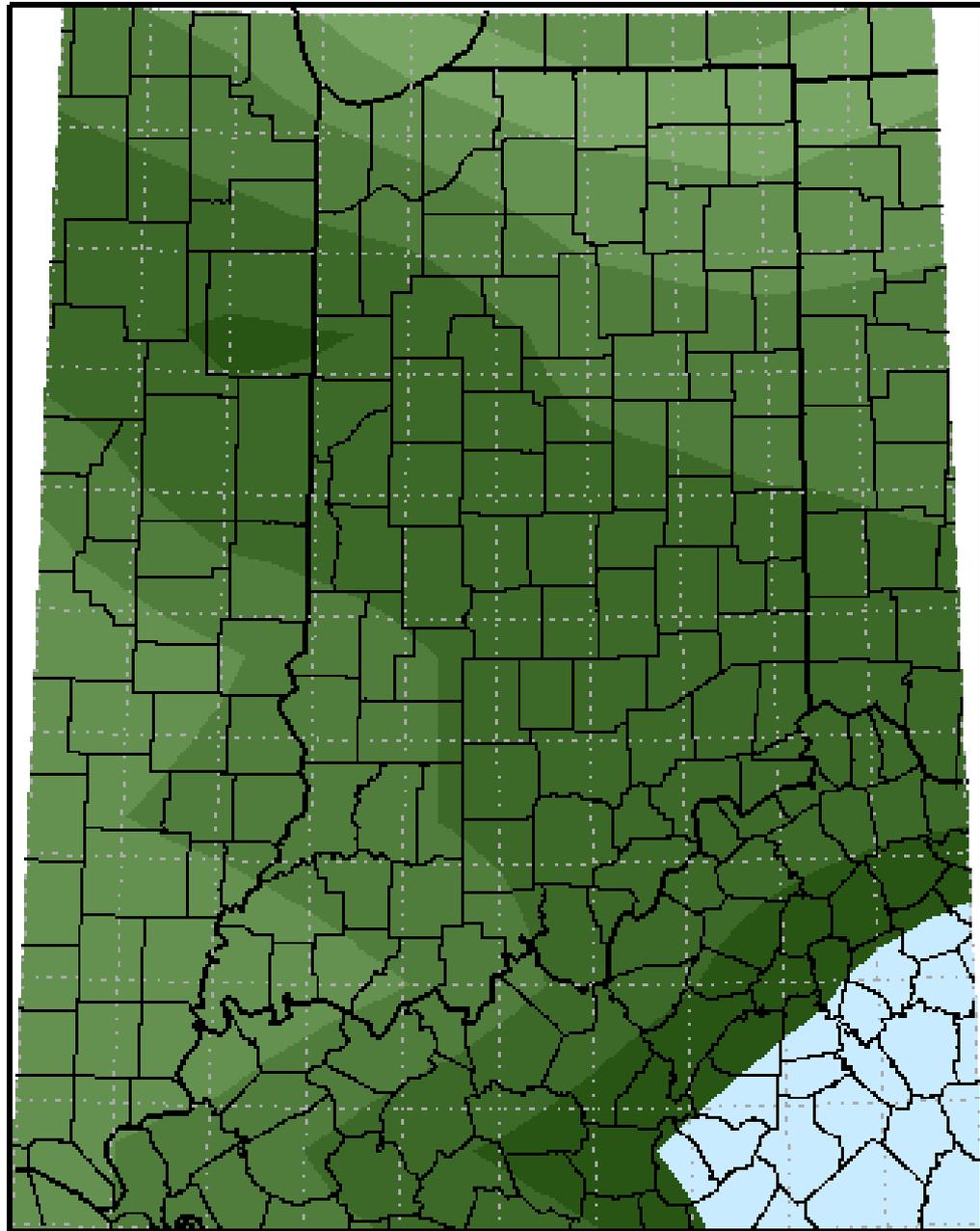


Midwestern Regional Climate Center

Illinois State Water Survey

Champaign, Illinois

**Average Temperature Departure from Mean in Degrees F  
December 1, 2010 to December 31, 2010**



**Midwestern Regional Climate Center**

**Illinois State Water Survey**

**Champaign, Illinois**

## *Drought Summary from the U.S. Drought Monitor*

Below is a drought summary for the state of Indiana from the U.S. drought monitor. Areas in white are not experiencing any drought. Yellow areas are abnormally dry, but not entirely considered a drought. Drought begins when the moisture levels become more severe, with beige, orange, red, and brown indicating increasing levels of drought (moderate, severe, extreme, and exceptional, respectively). The table below indicates how much of the state is not under drought conditions, and also how much of the state is under drought conditions from its respective column upwards.

For example, December 28<sup>th</sup> has 7.1% of Indiana under no drought, and 92.9% of Indiana under at *least* D0 through D4 drought status. This is followed by 13.6% as D1 through D4 status. To obtain the amount that is D0 status, simply subtract the D1-D4 column from the D0-D4 column, thus giving you the percentage of area with abnormally dry conditions (79.3%) . Please note, however, that these areas are not exact, and much of this drought map has been created from reports throughout the state and estimation, so use this information as a general view rather than for specifics.

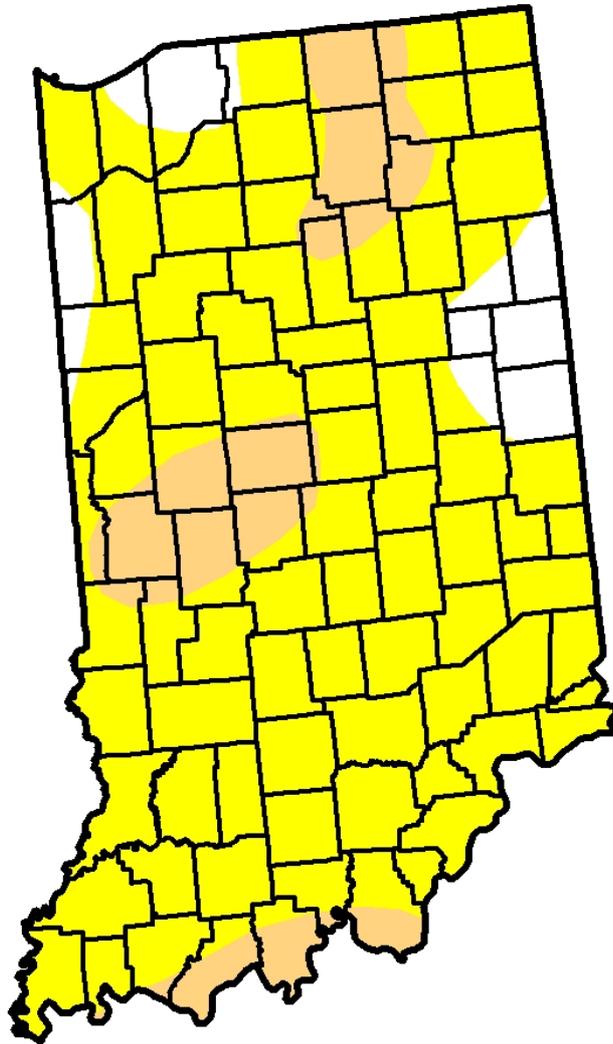
Intensity:

- D0 Abnormally Dry
- D1 Drought - Moderate
- D2 Drought - Severe
- D3 Drought - Extreme
- D4 Drought - Exceptional

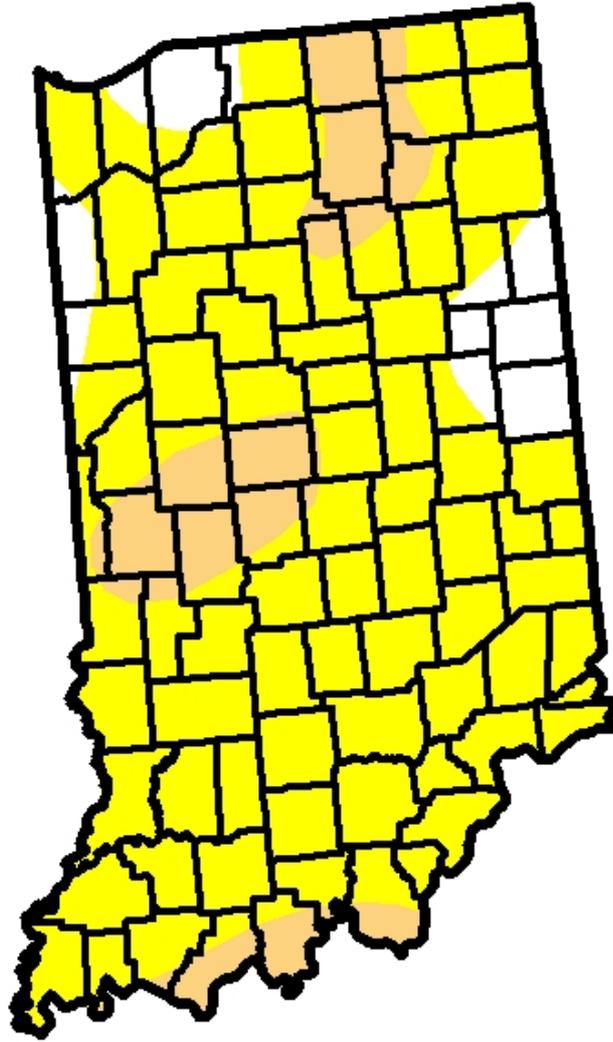
Week	None	D0-D4	D1-D4	D2-D4	D3-D4	D4
12/28/10	7.11	92.89	13.57	0.00	0.00	0.00
12/21/10	8.09	91.91	13.57	0.00	0.00	0.00
12/14/10	8.09	91.91	13.57	0.00	0.00	0.00
12/07/10	4.58	95.42	18.94	0.42	0.00	0.00



*December 14<sup>th</sup> Drought Summary*



*December 21<sup>st</sup> Drought Summary*



*December 28<sup>th</sup> Drought Summary*

